Technical Appendix 2.5: Glint and Glare Assessment

A specialist energy consultancy

Glint and Glare Assessment

M74 West Renewable Energy Park

Renewco Power Limited

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COMMERCIAL IN CONFIDENCE

Renewco POWER

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Executive Summary

TNEI has been commissioned to assess the possible effects of glint and glare from the proposed M74 West solar photovoltaic (PV) installation (the Proposed Development) located on land adjacent to the M74 Junction 13 Abington Interchange, South Lanarkshire.

This study assesses the potential effects on nearby dwelling occupants, road and rail users, and aviation receptors.

Dwellings: A total of 16 dwelling receptors have been identified within a 1 km buffer of the Proposed Development. Solar reflections are not geometrically possible at 11 receptors and there is adequate screening at an additional 2 receptors. There are no predicted impacts at these receptors.

There is one receptor where solar reflections are predicted (i.e. where it is geometrically possible and there is insufficient screening) but due to the calculated maximum daily duration (less than one hour a day) and occurrence within a year (less than three months in a year), the magnitude of impact is low.

There are 2 receptors where a moderate impact is anticipated due to solar reflections being predicted for longer than 3 months a year, with no adequate intervening screening in place, however, after consideration of the visibility of the panels, separation distance and location of the sun when solar reflections are predicted, it has been deemed that no mitigation measures are required for these receptors.

Roads: After a topographical analysis considering terrain data and the inclusion of additional screening features, such as landscaping and vegetation, a total of 8 road receptors have been identified where a high magnitude of impact is predicted. An additional 4 road receptors were identified with a moderate magnitude of impact. Mitigation will be required for the areas of high magnitude of impact and it is recommended for areas with a moderate magnitude of impact. A number of mitigation options are available and a detailed mitigation study would be undertaken prior to construction of the solar farm based on the final panel layout and specifications.

It is recommended that, should the Scottish Ministers be minded to grant consent, a suitably worded planning condition is included requiring the submission and approval of an updated roads glint and glare assessment and, where appropriate, scheme of mitigation, based on the finalised layout and panel specification.

Rail: A section of railway runs north south through the study area. There would be no visibility of the solar panels within the train driver's field of view. As such, the predicted impact is low, and no mitigation is recommended or required.

Aviation

No commercial airports or aerodromes are located within the 30 km study area. One privately owned grass airstrip is located approximately 8 km southwest of the Proposed Development, suitable for light aircraft and microlights.

There is no direct visibility of the Proposed Development form aircraft flight paths above or on approach to the airstrip, due to terrain screening. As such, no glint and glare effects are possible.

No impacts upon aviation activity are therefore predicted.

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1 Introduction

1.1 Introduction

1.1.1 TNEI has been commissioned by Renewco Power Limited (the Applicant) to assess the possible effects of glint and glare from a proposed solar photovoltaic (PV) installation located at the proposed M74 West Renewable Energy Park on land adjacent to the M74 Junction 13 Abington Interchange, South Lanarkshire (the Proposed Development).

1.1.2 This study assesses the potential glint and glare effects on nearby dwellings, road users, rail transport and local aviation operatives. The aims of this report are to:

- Identify receptors in the vicinity of the Proposed Development that are sensitive to glint and glare;
- Present calculated levels of glint and glare that might be incident on each of the receptor types; and
- Present details of the requirements for any mitigation, if necessary.

1.2 Glint and Glare Definition

1.2.1 All solar PV panels have the potential to produce a solar reflection, with the reflective properties of the panels varying between different manufacturers.

1.2.2 The definition of glint and glare can vary, however the definition used in this assessment follows that presented in the Pager Power '*Glint and Glare Guidance'* (Solar Photovoltaic and Building Development - Glint and Glare Guidance) as outlined below:

- Glint – a momentary flash of bright light, typically experienced by moderate to fast moving receptors, such as vehicles; and
- Glare – a continuous source of bright light, typically experienced by stationary or slow moving receptors, such as pedestrians or building occupants.

1.2.3 The term 'solar reflection' is used in this report throughout to refer to both reflection types i.e. glint and glare. Additionally, the following key points should be noted:

- Specular reflections of the sun from solar panels are possible;
- The measured intensity of a reflection from solar panels can vary from 2% to 30% depending on the angle of incidence; and
- The intensity of reflections from solar panels are equal to or less than those from water. Reflections from solar panels are significantly less intense than many other reflective surfaces which are common in an outdoor environment. They also vary depending on the type of surface a panel has, such as if the panel is smooth or textured, or if an anti-reflective coating has been applied.

2 Proposed Development Description

2.1 Proposed Solar Development Panel Area

2.1.1 The solar farm comprises ten distinct PV arrays, the majority of which are located on land either side of the M74 Junction 13 Abington Interchange, along with a small number of arrays further to the southwest, located south of the B7078. Four of the arrays are located immediately to the northeast of the M74, and three are located immediately to the southwest. One array is located adjacent to the B7078 (to the south), and the remaining two arrays are located approximately 800 m to the southwest. A map indicating the layout of the Proposed Development is provided in Figure A1.1 in Annex A.

2.2 Photovoltaic Panel Mounting Arrangements and Orientation

2.2.1 The geometrical parameters of the solar panels are listed in Table 2-1, the details of which have been used in all glint and glare modelling to produce the results presented herein.

Table 2-1 Proposed Solar Panel Arrangement Details

Feature	Detail
Panel Tilt	30 degrees[1]
Panel Orientation	0 degrees (facing south)
Height of Panel Above Ground	The panels are assumed as maximum 1.1m m off the ground at the lowest point, with a maximum panel height of 3.1 m.

[1] Optimal angle determined by WindPro modelling software, based on latitude.

3 Current Policy, Guidance and Best Practice

3.1 UK Planning Policy

3.1.1 Although the UK National Planning Practice Guidance states the requirement for glint and glare assessment in some instances, there is no specific guidance with respect to the methodology for assessing the impact of glint and glare.

3.1.2 The National Planning Policy Framework for Renewable and Low Carbon Energy (Renewable and low carbon energy. Paragraph 013 (Reference ID: 5-013-20150327)) states:

"The deployment of large-scale solar farms can have a negative impact on the rural environment, particularly in undulating landscapes. However, the visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively.

Particular factors a local planning authority will need to consider include:

- *The proposal's visual impact, the effect on landscape of glint and glare and on neighbouring uses and aircraft safety;*
- *The extent to which there may be additional impacts if solar arrays follow the daily movement of the Sun;*

The approach to assessing cumulative landscape and visual impact of large scale solar farms is likely to be the same as assessing the impact of wind turbines. However, in the case of ground-mounted solar panels, it should be noted that with effective screening and appropriate land topography the area of a zone of visual influence could be zero".

3.2 Guidance and Studies

3.2.1 There are limited formal guidelines available for the assessment of glint and glare, however, the following technical notes and guidelines can be referred to;

- Pager Power (2020 – Third edition), "Solar Photovoltaic and Building Development – Glint and Glare Guidance";
- Evan Riley and Scott Olsen (2011), "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems" (Olson); and
- Federal Aviation Administration (FAA) Guidance (2018), *"Technical Guidance for Evaluating Selected Solar Technologies on Airports"* (Technical Guidance for Evaluating Selected Solar Technologies on Airports).

3.3 Assessment Process

3.3.1 There is no formal process for determining and contextualising the effects of glint and glare. As such, the methodology and approach detailed within Section 4 of this Study determines whether a reflection from the proposed solar development is geometrically possible and the results are then compared against the relevant guidance/studies to determine whether the reflection is significant.

4 Methodology

4.1 Prediction Methodology

4.1.1 The glint and glare prediction and methodology, which has been derived through reviewing the guidance presented in Section 3.2, is as follows;

- Identify receptors in the area surrounding the Proposed Development;
- Determine the occurrence of direct solar reflections from the proposed solar development towards the identified receptors by undertaking geometric calculations[2];
- Determine the visibility of the panels from the receptor's location, accounting for intervening screening, such as structures, buildings, topography etc. If the panels are not visible from the receptor then no reflection can occur;
- Where reflections are predicted and unscreened determine at what time of the year and time of day it would occur;

4.1.2 The Sun's position in the sky can be accurately described by its azimuth and elevation. Azimuth is a direction relative to true north (horizontal angle i.e. from left to right) and elevation describes the Sun's angle relative to the horizon (vertical angle i.e. up and down).

4.1.3 The Sun's position can be accurately calculated for a specific location. The following data being used for the calculation:

- Time;
- Date;
- Latitude; and
- Longitude.

4.1.4 The combination of the Sun's azimuth angle and vertical elevation would affect the direction and angle of the reflection from a solar panel.

4.2 Defining Magnitude of Impact

4.2.1 The PagerPower Guidance presents a table of "Impact Significance Definition", reproduced here as Table 4-1, which can be used to establish a magnitude of impact for glint and glare. The corresponding requirement for mitigation for each magnitude is also described.

Table 4-1: Impact Significance Definition

Impact Significance	Definition	Mitigation Requirements
No Impact	A solar reflection is not geometrically possible or will not be visible from the assessed receptor.	No mitigation is required

[2] Geometric calculations consider only the angles between the sun, PV panels, and receptor, and do not consider topographic screening.

Impact Significance	Definition	Mitigation Requirements
Low	A solar reflection is geometrically possible however any impact is small such that mitigation is not required e.g. intervening screening will limit the view of the reflecting solar panels significantly.	No mitigation is required.
Moderate	A solar reflection is geometrically possible and visible, however, it occurs under conditions that do not represent a worst-case.	Whilst the impact may be acceptable, consultation and/or further analysis should be undertaken to determine the requirement for mitigation and/or recommendations for or against mitigation should be made by an expert on a case by case basis with suitable reasoning.
High	A solar reflection is geometrically possible and visible under conditions that will produce a significant impact. Mitigation and consultation is recommended.	Mitigation will be required if the proposed development is to proceed.

4.3 Assessment Methodology by Receptor Type

4.3.1 The following tables detail the assessment methodology for the receptor types considered in this study. Specifically;

- Table 4-2 details the assessment methodology for residential receptors (dwellings);
- Table 4-3 details the assessment methodology for road users;
- Table 4-4 details the assessment methodology for railways; and,
- Table 4-5 details the assessment methodology for aviation receptors.

Table 4-2: Assessment Process and Outcomes for Dwellings

Assessment Process	Action & Determination of Impact Significance
1) Are solar reflections geometrically possible at the receptor location?	If no, then there is no impact and no requirement for mitigation. If yes, see (2).
2) Are solar reflections likely to be experienced in practice due to the existing and proposed levels of screening?	If no, then there is no impact and no requirement for mitigation. If yes, see (3).
3) Are solar reflections likely to be experienced for: A) Greater than 60 minutes during a single day. B) Greater than 3 months in a year.	If neither condition (A) or (B) are met, then the impact is low and there is no requirement for mitigation. If one condition is met, then there is a moderate impact and mitigation should be considered on a case by case basis. If both conditions are met, then the impact is high and mitigation is required to reduce that impact.

Table 4-3: Assessment Process and Outcomes for Road Users

Consideration	Action & Determination of Impact Significance
1) Are solar reflections geometrically possible and visible at the receptor location?	If no, then there is no impact and no requirement for mitigation. If yes, see (2).
2) Are solar reflections incident upon a major national, national, regional, or local road?	If solar reflections are incident upon a local road, then they are of low impact and no mitigation is required. If solar reflections are incident on any other road type, then see (3).
3) Do the solar reflections originate within a road user's field of view (within 50 degrees from the direction of travel)?	If no, then there is a low impact and no requirement for mitigation. If yes, then see (4).
4) Do the solar reflections originate within the field of view of the road user without any mitigating circumstances?	If no, then there is a moderate impact and site-specific mitigation should be considered. If yes, then the impact is high and mitigation is required to reduce that impact.

Table 4-4: Assessment Process and Outcomes for Rail Users

Consideration	Action & Determination of Impact Significance
1) Are solar reflections geometrically possible and visible at the receptor location?	If no, then there is no impact and no requirement for mitigation. If yes, see (2).
2) Do the solar reflections originate within the train driver's field of view (within 30 degrees from the direction of travel)?	If no, then there is a low impact and no requirement for mitigation. If yes, then see (3).
3) Do the solar reflections originate within the field of view of the train driver without any mitigating circumstances?	If no, then there is a moderate impact and site-specific mitigation should be considered. If yes, then the impact is high and mitigation is required to reduce that impact.

Table 4-5 Assessment Process and Outcomes for Aviation Receptors*

Consideration	Action & Determination of Impact Significance
1) Are solar reflections geometrically possible at the receptor location?	If no, then there is no impact and no requirement for mitigation. If yes, see (2).
2) Do the solar reflections have a maximum intensity of "low potential for after-image"?	If yes, then there is a low impact and no requirement for mitigation. If no, see (3).

Consideration	Action & Determination of Impact Significance
3) Do the solar reflections have a maximum intensity of "potential for after-image"? [3]	If yes, see (4). If no, then the intensity of the solar reflection is greater than "potential for after-image" and therefore of a high impact and mitigation should be implemented to reduce impacts.
4) Do the solar reflections occur for a significant duration and/ or at a significant time of day (e.g. peak operational periods at an airfield)?	If no, then there is a moderate impact and further consultation with the aerodrome is required to determine the requirement for mitigation. If yes, then there is a high impact and mitigation should be implemented to reduce impacts.
* Typical aviation receptors include operators within Air Traffic Control Towers (ATCT) or pilots within aircraft that are landing or taking off. There are no ATCTs within the defined study area, therefore, only aircraft flight paths have been considered in this assessment.	

4.4 Assessment Limitations and Assumptions

4.4.1 The guidance followed in this assessment represents good practice rather than legislative requirements. It is conservative and precautionary in nature, particularly with regards to effects on transport receptors, where any potential for a single glint and glare event on major roads is classed as a high impact.

4.4.2 The assessment has been based on a panel layout and dimensions provided by the Applicant, however the final detailed design may differ from that presented here.

4.4.3 Only a reflection from the face of the panel has been considered. The frame or the reverse of the solar panel has not been considered.

4.4.4 Whilst line of sight to the development from receptors has been considered, only available street view imagery, site photos and satellite mapping has been used. In some cases, this imagery may not be up to date and may not give the full perspective of the installation from the location of the assessed receptor.

4.4.5 Any screening in the form of trees, buildings etc. that may obstruct sunlight reaching the solar panels is not considered within the software model, which may lead to an over-estimation of glint and glare effects.

4.5 Study Area

4.5.1 Study Area for Ground-Based Receptors

4.5.2 There is no formal distance within which glint and glare should be assessed. The impact of a reflection decreases with distance, due to the dispersion of the reflection and atmospheric attenuation, as well as any intervening obstructions such as vegetation or buildings providing screening. Where the modelling reveals a reflection would be geometrically possible and the magnitude of impact is high or moderate then the assessment then considers visibility and screening, separation distance and the sun's position during the predicted glare periods.

[3] The likelihood of a solar reflection continuing to appear in one's vision after the exposure to the original image has ceased.

4.5.3 The PagerPower guidance suggests a 1 km study area is typically appropriate for an assessment on road and residential receptors, and a 500 m study area is considered appropriate for rail receptors.

4.5.4 Identification of Dwellings

4.5.5 The assessment has considered dwellings within the study area with a potential view of the panels. In some cases, a single representative assessment location has been defined to represent multiple properties that are in close proximity to each other.

4.5.6 The assessed receptor points for dwellings have been taken from an observer height of 4 m, which is typically used as the eye level for an observer through a first-floor window of a dwelling.

4.5.7 A total of 16 receptor locations have been included in the assessment, which are shown on Figure A1.1 (in Annex A).

4.5.8 Identification of Roads

4.5.9 Roads can be split up into the following categories:

- **Major National**: A road with a minimum of two carriageways and a maximum speed limit of up to 70 mph. These roads typically have fast moving vehicles with high traffic numbers;
- **National**: A road with one or more carriageways and a maximum speed limit of up to 60 mph. These roads typically have fast moving vehicles with moderate to high traffic numbers;
- **Regional**: A road with a single carriageway with a maximum speed limit of up to 60 mph. The speed of vehicles along these roads would typically vary and have low to moderate traffic numbers; and,
- **Local**: Roads or lanes with varying speed limits and typically low traffic numbers.

4.5.10 Typically, glint and glare assessments include through-roads, but exclude access roads or those with exceptionally low traffic volumes or speeds, such as unpaved roads. No access roads, unpaved roads or similar have been identified that require to be considered in this assessment.

4.5.11 The M74 Motorway runs from northwest to southeast through the middle of the Proposed Development, and changes to the A74(M) at Junction 13 Abington Interchange. Additional roads that fall within study area include the A702, A73, B7078 and various local roads. The categorisation of each identified road within the study area is presented in Table 4-6 and indicated on Figure A1.1 (Annex A).

Table 4-6 Roads Categories Identified Within the Study Area

Road	Category
M74 / A74(M)	Major National
A702, A73	National
B7078	Regional
Craighead Road, unnamed roads	Local

4.5.12 To undertake the assessment on road users, assessment locations have been defined along each of these roads at 200 m increments and at a height of 1.5 m, in line with recommendations of the Pager Power guidance.

4.5.13 Study Area for Aviation Receptors

4.5.14 A study area for airports, aerodromes and airfields of 30 km has been considered.

4.5.15 One receptor has been identified within the study area. Crawfordjohn Airfield is located approximately 8 km to the southwest and consists of a small private grass airstrip suitable for light aircraft and microlights. There is no air traffic control tower on the site.

4.5.16 No commercial or large-scale airports/aerodromes have been identified within the study area.

5 Glint and Glare Assessment

5.1 Overview

5.1.1 Table 5-1 through to Table 5-3 summarise the magnitude of impact for each receptor, with each table differentiating between receptor type. It is recommended that the Tables be read alongside Figure A1.3, which details the locations of all assessment locations and whether any glint or glare would be possible at that location. Coordinates for all assessment locations are included in Annex B.

5.1.2 Any existing screening used within the modelling is determined based upon the topographical dataset, available aerial imagery, and ground level imagery from Google Streetview. The approach is designed to be conservative. Where it is unclear whether views would be available, it is assumed that there would be visibility.

5.1.3 Detailed assessment results for all receptors can be found in Annex C.

5.2 Impact Assessment: Dwellings

5.2.1 The results of the residential receptor assessment are presented within Table 5-1. Where the commentary within the table refers to 'time of occurrence,' this is the earliest and latest start and end time over several weeks or months, and not the duration of any one event. For example, a Time of Occurrence between 17:00 and 19:00 in May and June would mean that glare could start as early as 17:00 and end as late as 19:00 during these two months but it does not necessarily indicate that the duration of glare is 2 hours. Detailed results can be found in the assessment charts in Annex C in this regard.

Table 5-1 Assessment of Dwelling Receptors

Receptor(s)	Are solar reflections geometrically possible?		Comments
	AM	PM	
Netherton Craighead Maidencots 2 Whitrae Wood 1 Whitrae Wood 2 Carlisle Road Nether Abington 1 Littlegill Bridegend Road Maidencots 1 Maidencots 3	No	No	No solar reflections are geometrically possible. **No impacts are predicted.**
Nether Abington 2	No	Yes	At this location solar reflections are geometrically possible in the evenings

Receptor(s)	Are solar reflections geometrically possible?		Comments
	AM	PM	
			during May to August. The time of occurrence falls between 17:30 – 19:30. The solar reflections are predicted to occur from PV Array E. However, based on a review of available imagery, there is adequate screening in place from agricultural sheds and outbuildings to the west and north of the property such that the predicted glare will not be experienced in practice. Therefore, **no impact is predicted.**
Cold Chapel	No	Yes	At this location solar reflections are geometrically possible in the evenings during April to September. The time of occurrence falls between 18:00 – 19:30. The solar reflections are predicted to occur from PV Array F. However, based on a review of available imagery, there is adequate screening in place from trees and vegetation to the west and north of the property such that the predicted glare will not be experienced in practice. Therefore, **no impact is predicted.**
Littlegill Cottage	No	Yes	At this receptor solar reflections are geometrically possible in the evenings during March, and September to October. The time of occurrence falls between 17:45 – 19:00. The solar reflections are predicted to occur from PV Array G. It is predicted that the glare will be less than 60 minutes a day and less than 3 months in a year. Therefore, **the predicted impact is low and no mitigation is required.**

Receptor(s)	Are solar reflections geometrically possible?		Comments
	AM	PM	
Dykefoot	No	**Yes**	At this receptor solar reflections are geometrically possible in the evenings during March to September. The time of occurrence falls between 17:30 – 19:30. The solar reflections are predicted to occur from PV Array F and Array G. It is predicted that the glare will be less than 60 minutes a day but will occur for more than 3 months in a year. Therefore, the **predicted impact is moderate**. Accordingly, further consideration has been given based upon visibility, separation distance and the sun's position during the predicted glare periods. <u>Visibility:</u> There is partial screening due to trees and bushes planted in the garden on the western side of the property, which will prevent direct line of sight to much of Array F and parts of Array G. Further screening of Array F is provided by the buildings at Abington services, to the west, and the junction earthworks. <u>Separation distance:</u> The closest reflective surface is over 600 m away, with the furthest being >1,000 m away, such that any glare will be mitigated by the reduction in image size with respect to distance. <u>Sun position:</u> The predicted glare occurs in the evening and with solar reflections incident from the west, the same direction as the sun. Therefore, the impact of any experienced glare will be reduced due to the

Receptor(s)	Are solar reflections geometrically possible?		Comments
	AM	PM	
			reflections coinciding with direct sunlight. It is determined that **mitigation is not required** due to these additional considerations, which diminish the impact of any predicted glare.
Duneaton House	Yes	Yes	At this receptor solar reflections are geometrically possible in the evenings during March to April, and August to September. The time of occurrence falls between 17:45 – 19:30 as a result of reflections from PV Array B. Solar reflections are also geometrically possible in the mornings during April to September. The time of occurrence falls between 06:15 – 08:00 as a result of reflections from PV Array E. It is predicted that each instance of glare will be less than 60 minutes a day but will occur for more than 3 months in a year. Therefore, the **predicted impact is moderate**. Accordingly, further consideration is required based upon visibility, separation distance and the sun's position during the predicted glare periods. Visibility: There is no screening of Array B to the west of the receptor, however there is complete screening of PV Array E to the east of the receptor, due to terrain. Array E is located on the eastern slope of Craighead Hill, and as such will not be visible from Duneaton House, located to the west of the hill. With potential glare effects from Array E discounted, glare from Array B could occur for a

Receptor(s)	Are solar reflections geometrically possible?		Comments
	AM	PM	
			maximum of 93 days, or 3 months, per year. This being the case, the **predicted impact would be low**. Separation distance: The closest reflective surface is approximately 230 m away, with the furthest being 530 m away, such that any glare will be mitigated by the reduction in image size with respect to distance. Sun position: The predicted glare occurs in the evening and with solar reflections incident from the west, the same direction as the sun. Therefore, the impact of any experienced glare will be reduced due to the reflections coinciding with direct sunlight. It is determined that **mitigation is not required** due to these additional considerations diminishing the impact of any predicted glare.

5.3 Impact Assessment: Roads

5.3.1 Each road assessment location was spaced in 200 m intervals along the assessed roads to provide full coverage of the road network within the study area. Using the methodology presented within Table 4-2, each receptor has been assessed, and where applicable, a magnitude of impact and requirement for mitigation determined.

5.3.2 Due to the extensive road infrastructure located within the study area, an assessment of topography and additional screening features has been undertaken to ascertain where visibility of the panels is likely to occur and to determine recommendations for where mitigation measures will be required.

5.3.3 Results of the assessment are presented within Table 5-2. For brevity, only the receptors where moderate or high impacts are predicted are presented, and a full assessment of all receptors is included in Annex C. Of the 91 assessed locations, 79 have been determined to have no or low impacts and 12 have been classified as requiring some form of mitigation.

5.3.4 Where a high impact is identified, mitigation would be required to reduce the level of impact and there are two different approaches to mitigation that can be taken: either reduce the

intensity of glare from the panels themselves, through the use of specially designed panel coatings and/or glass, or obstruct the line of sight between the panels and the receptors.

5.3.5 Table 5-2 considers the potential for mitigation in the form of screening to be positioned at the roadside, however, alternative approaches may be possible. The nature and scale of effects may reduce through more detailed analysis and so a detailed mitigation study considering the areas of high impact and the finalised detailed design and selected plant to be installed, would be undertaken prior to construction.

Table 5-2 Assessment of Road Receptors

Assessment Location	Magnitude of Impact without Mitigation	Comments
M74-6	High	Glint and glare is geometrically possible and effects are within the Field of View (FOV) of southbound traffic. Visibility exists towards the panels (no existing screening is present), therefore mitigation is required in order to reduce impacts.
M74-7 M74-8 M74-13	Moderate	Glint and glare is geometrically possible at these receptor locations and effects are within the FOV of road users on both northbound and southbound carriageways. Visibility is partially screened by existing planting and landscaping, though some additional mitigation is recommended to reduce impacts.
M74-9 M74-10 M74-11 M74-12	High	Glint and glare is geometrically possible at these receptor locations and effects are within the FOV of road users on both northbound and southbound carriageways. Visibility exists towards the panels (no existing screening is present), therefore mitigation is required to reduce impacts.
B7078-2	Moderate	Glint and glare is geometrically possible at this receptor location and effects are within the FOV of road users on the northbound carriageway. Visibility is partially screened by existing planting, however, additional mitigation is recommended to reduce impacts.
B7078-1 B7078-3 B7078-4	High	Glint and glare is geometrically possible, and effects are within the FOV of road users on both northbound and southbound carriageways. Visibility exists towards the panels (no existing screening is present), therefore mitigation is required to reduce impacts.

5.3.6 It is recommended that, should the planning authority be minded to grant consent, a suitably worded planning condition is included requiring the submission and approval of a detailed mitigation plan.

5.4 Impact Assessment: Rail

5.4.1 Six rail assessment locations were considered, separated at 200 m intervals along the length of the West Coast Main Line that lies within the study area. The results of the assessment are presented in Table 5-3.

Table 5-3 Analysis of Rail Receptors

Receptor	Are solar reflections geometrically possible?		Comments
	AM	PM	
1	No	No	No solar reflections are geometrically possible. **No impacts are predicted.**
2 – 6	No	**Yes**	Solar reflections are geometrically possible, however they are outside of the field of the train driver's FOV (30° either side of the direction of travel). Therefore, the **predicted impact is low**, and **no mitigation is recommended.**

5.5 Impact Assessment: Aviation

5.5.1 An assessment of sightlines and topography between Crawfordjohn Airfield and the Proposed Development has been undertaken to assess the possibility of glint and glare effects on aircraft using the airstrip. The assessment considers the stated height of the flight circuit[4] above the airstrip (250 m). At lower heights the effects of terrain screening are more pronounced so this provides a worst case assessment.

5.5.2 Figure A1.2 (Annex A) presents a Zone of Theoretical visibility (ZTV) calculation that shows no line of sight is present between the airstrip flying circuit and the Proposed Development due to terrain screening. Accordingly, no glint and glare effects are anticipated for aircraft using the airfield and **there is no impact predicted**.

[4] As detailed at: https://www.flexwingscotland.co.uk/crawfordjohn-stonehill-farm/

6 Conclusion

6.1 Dwellings

6.1.1 The key considerations for quantifying impact magnitude on dwellings are:

- Whether a solar reflection is predicted in practice; and
- The total duration in which a reflection would occur in practice, considering both the duration of the refection event and the number of days in which reflections could be experienced.

6.1.2 A total of 16 dwelling receptors have been assessed which provide a representative sample of receptors in all directions within a 1 km buffer of the proposed development. It has been determined that solar reflections are not geometrically possible at 11 receptors. There are 2 receptors in which solar reflections are geometrically possible, but there is adequate screening in place such that reflections are not expected to be experienced in practice.

6.1.3 There is 1 receptor where solar reflections are possible and there is not adequate screening in place, but due to the maximum length of time the solar reflections are predicted in a day, and the limited occurrence across a year, these receptors are deemed to receive solar reflections of low impact and as such no mitigation is required.

6.1.4 Finally, there are 2 receptors in which a moderate impact due to solar reflections is predicted. In both instances this is due to solar reflections being predicted for longer than 3 months each year without adequate screening providing mitigation. Accordingly, further assessment has been undertaken to consider three factors: panel visibility, sun position and separation distance. For each receptor at which a moderate impact was predicted, when these additional factors were considered, it was been deemed that the impact of the solar reflections has been diminished such that mitigation measures are not required.

6.1.5 Impacts on residential dwellings will be primarily **no impact or low impact, with two dwellings considered moderate impact**, however due to existing mitigating circumstances no mitigation measures are recommended.

6.2 Road

6.2.1 The key considerations for quantifying impact significance on road users are:

- Whether a solar reflection is predicted in practice;
- The significance of the road; and
- The location of the reflecting panel relative to the road user's direction of travel.

6.2.2 After topographical analysis of terrain data and additional screening features, a total of 8 road receptors were determined in which the magnitude of impact is high and therefore mitigation is required to reduce impacts. A further 4 road receptors have been identified where the magnitude of impact is moderate and mitigation is also recommended to reduce impacts. A number of mitigation options are available and a detailed mitigation study should be undertaken prior to the construction of the solar farm based on the final panel layout and specifications.

6.2.3 It is recommended that a suitably worded planning condition is included within any planning consent requiring the submission and approval of a detailed screening assessment prior to construction.

6.3 Rail

6.3.1 Glint and glare effects are geometrically possible for a short section of the West Coast Main Line located within 500 m of the Proposed Development, however there is no visibility of the solar panels within the train driver's FOV. As such, **the predicted impact is low**, and **no mitigation is recommended or required**.

6.4 Aviation

6.4.1 No visibility exists between aircraft using the Crawfordjohn Airstrip and the Proposed Development due to intervening topography. Therefore, **no impact upon aviation is expected**.

6.5 Cumulative Impacts

6.5.1 There are no cumulative solar developments within 1 km of the road, rail or dwelling receptors considered in this assessment. As such, there is no prospect for cumulative effects to occur, therefore there will be **no cumulative impact**.

7 References

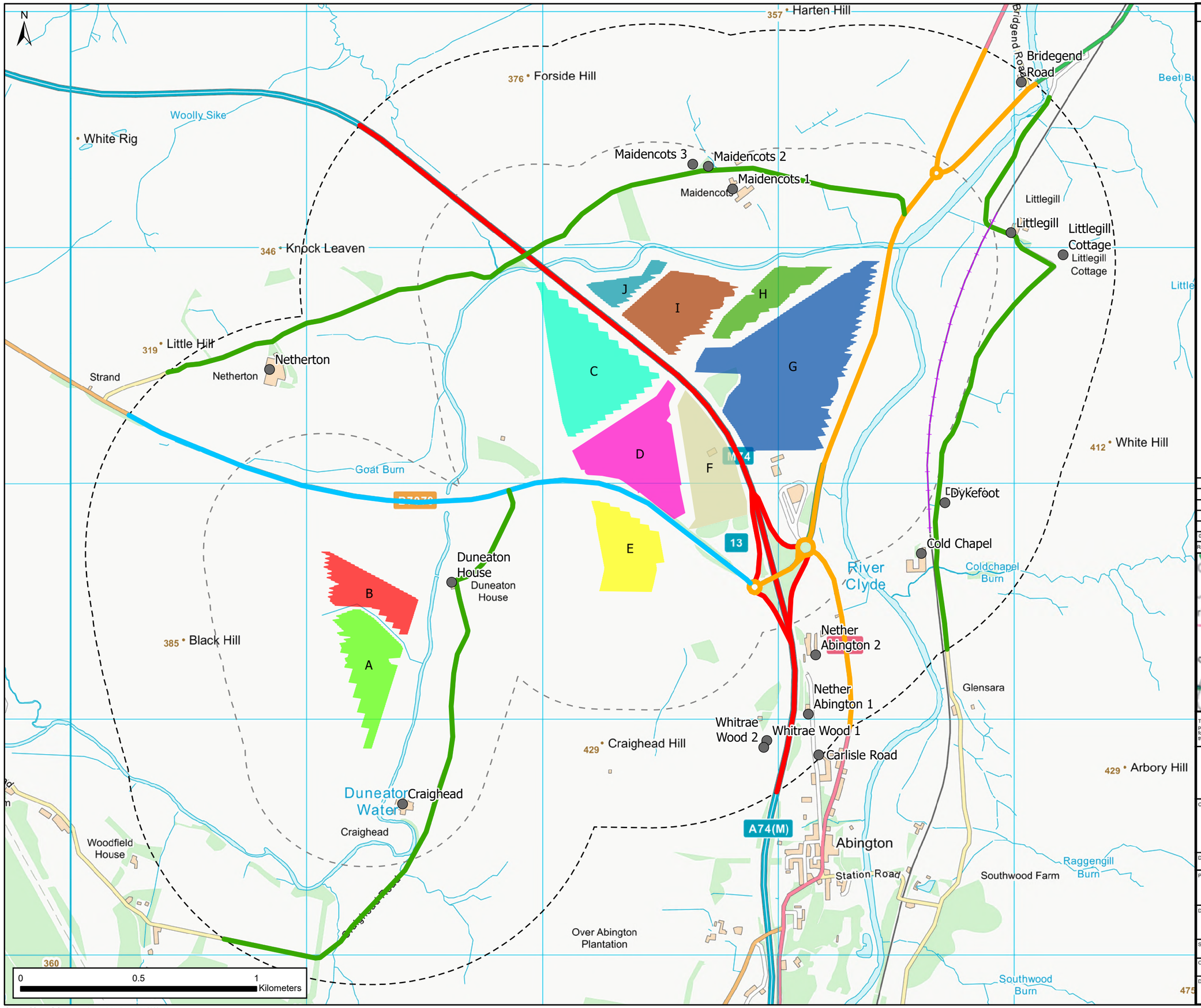
Olson, Evan Riley and Scott. “A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems.” 2011 (2011).

“Renewable and low carbon energy. Paragraph 013 (Reference ID: 5-013-20150327).” 2015.

“Solar Photovoltaic and Building Development - Glint and Glare Guidance.” 2020.

Technical Guidance for Evaluating Selected Solar Technologies on Airports. Washington, DC: Federal Aviation Administration, 2018.

Annex A – Figures



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LEGEND

PV Array
- A
- B
- C
- D
- E
- F
- G
- H
- I
- J

500m Buffer of Solar Panels (Raill)

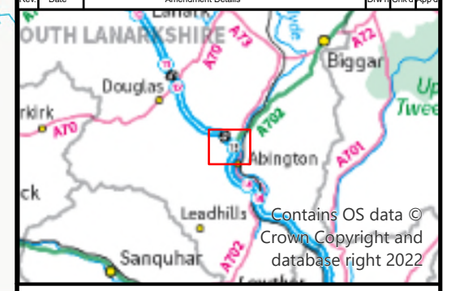
Rail Lines within 500m of PV Arrays

1km Buffer of Solar Panels (Road & Residential)

Dwelling Receptors

Roads within 1km of PV Arrays
- Major National
- National
- Regional
- Local

Rev.	Date	Amendment Details	Drwn	Chk'd	App'd
00	21/06/24	DRAFT	MT	--	--



tnei

Client: Renewco POWER

Drawing Status: DRAFT

Project Title: M74 West Renewable Energy Park

Drawing Title: Figure A1.1 - Identified Receptors

Scale	Designed	Drawn	Checked	Approved
1:15,000	MT	MT	DRAFT	DRAFT
Original Size	**Date**	**Date**	**Date**	**Date**
A3	21/06/2024	21/06/2024	--	--

Drawing Number: 15990-013

Revision: D0

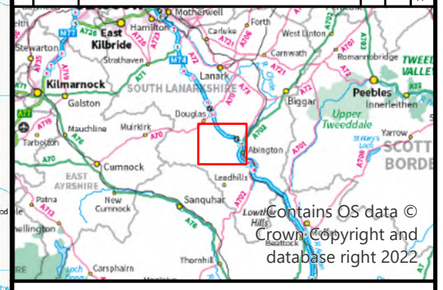
LEGEND

- Crawordjohn Airfield (SW/NE Extents)
- Area visible from point A
- Area visible from point B

PV Array

- A
- B
- C
- D
- E
- F
- G
- H
- I
- J

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
00	21/06/24	DRAFT	MT	--	--



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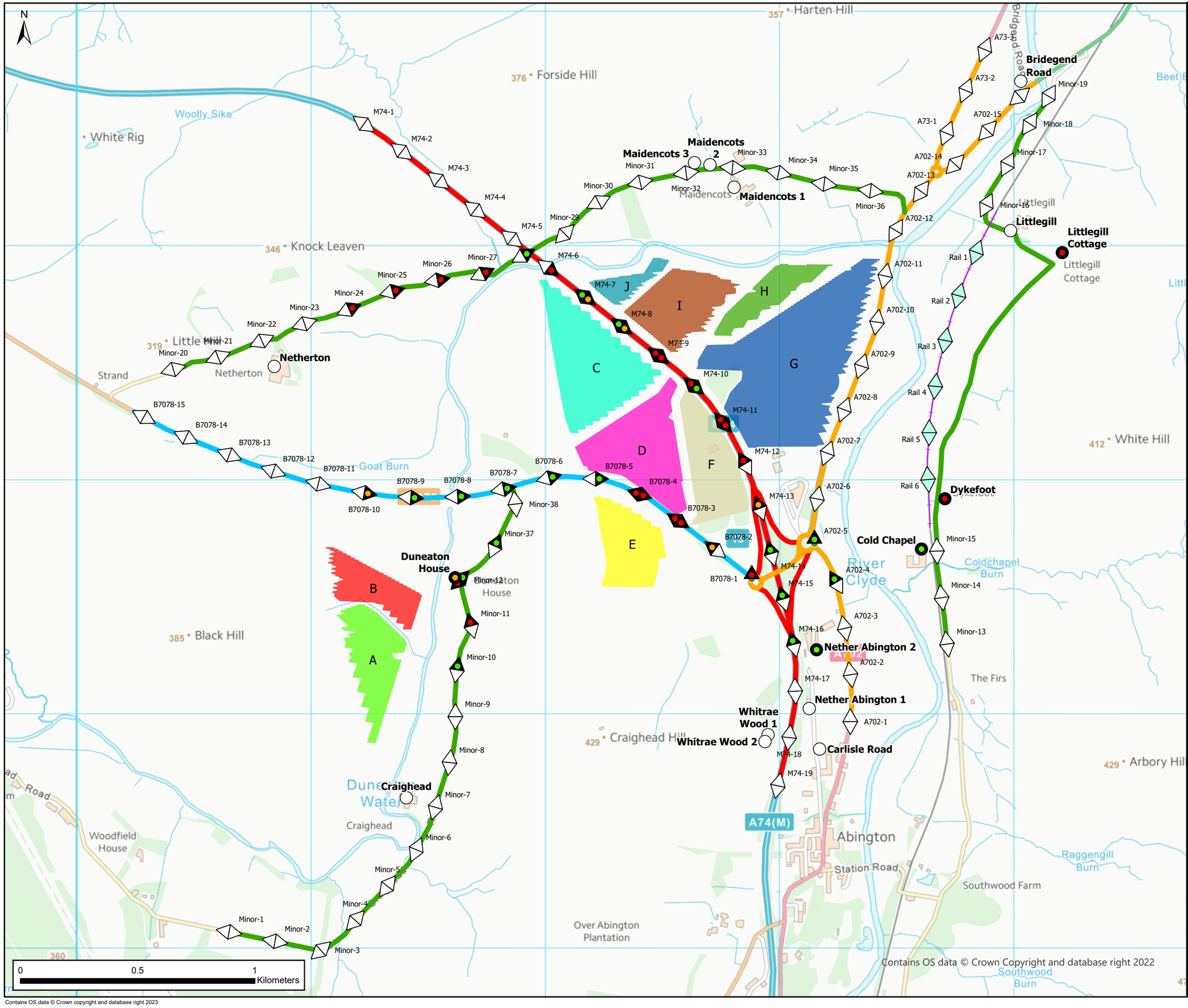
Client: Renewco POWER

Drawing Status	DRAFT
Project Title	M74 West Renewable Energy Park
Drawing Title	Figure A1.2 - Airfield Receptors

Scale	Designed	Drawn	Checked	Approved
1:35,000	MT	MT	DRAFT	DRAFT
Original Size	**Date**	**Date**	**Date**	**Date**
A3	21/06/2024	21/06/2024	--	--

Drawing Number	Revision
15990-014	D0

0 1.25 2.5 5 Kilometers



LEGEND

PV Array
- A
- B
- C
- D
- E
- F
- G
- H
- I
- J

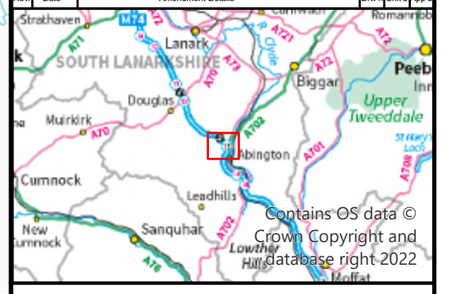
Rail Lines within 500m of PV Arrays

Roads within 1km of PV Arrays
- Major National
- National
- Regional
- Local

- Dewlling - No G&G Possible
- Dewlling - G&G Predicted
- Road - No G&G Possible within 100° FOV
- Road - G&G Predicted within 100° FOV
- Rail - No G&G Possible within 60° FOV
- Rail - G&G Predicted within 60° FOV

Existing Screening
- No
- Partial
- Yes

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
00	21/06/24	DRAFT	MT	--	--



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Client: Renewco POWER

Drawing Status: DRAFT

Project Title: M74 West Renewable Energy Park

Drawing Title: Figure A1.3 - Results

Scale	Designed	Drawn	Checked	Approved
1:15,000	MT	MT	DRAFT	DRAFT
Original Size	**Date**	**Date**	**Date**	**Date**
A3	21/06/2024	21/06/2024	--	--

Drawing Number: 15990-015

Revision: D0

Annex B: Receptor Details & Assessment Locations

Dwelling Receptor Details

Receptor	OS Coordinate (X)	OS Coordinate (Y)	Height above ground level (m)	Total elevation (m)
Netherton	290843	625484	4	298.1
Duneaton House	291615	624582	4	245.3
Craighead	291407	623642	4	247.2
Whitrae Wood 1	292951	623911	4	286.6
Whitrae Wood 2	292938	623882	4	285.9
Carlisle Road	293171	623850	4	252.6
Nether Abington 1	293127	624023	4	258.5
Nether Abington 2	293158	624274	4	252.7
Cold Chapel	293606	624704	4	240.2
Dykefoot	293706	624919	4	242.6
Littlegill Cottage	294207	625970	4	253.6
Littlegill	293986	626064	4	235.1
Bridegend Road	294030	626702	4	228.9
Maidencots 1	292806	626249	4	257.3
Maidencots 3	292637	626354	4	273.6
Whitrae Wood 1	292951	623911	4	286.6

Road Receptor Details

Receptor	OS Coordinate (X)	OS Coordinate (Y)	View Direction A (°)	View Direction B (°)	Height above ground level (m)	Ground elevation (m)
M74-1	291225	626519	125	305	1.5	265.8
M74-2	291387	626402	127	307	1.5	255.9
M74-3	291544	626278	127	307	1.5	250.8
M74-4	291700	626153	127	307	1.5	246.5
M74-5	291857	626029	127	307	1.5	240.6
M74-6	292013	625904	127	307	1.5	236.5
M74-7	292170	625780	127	307	1.5	245.2
M74-8	292326	625655	127	307	1.5	252.1
M74-9	292483	625530	127	307	1.5	254
M74-10	292634	625400	130	310	1.5	254.9
M74-11	292759	625244	140	320	1.5	251.3
M74-12	292853	625068	150	330	1.5	248.4
M74-13	292915	624878	160	340	1.5	248.2
M74-14	292965	624685	164	344	1.5	251.2
M74-15	293016	624491	164	344	1.5	255.5
M74-16	293060	624297	166	346	1.5	258.7
M74-17	293067	624097	177	357	1.5	266.2
M74-18	293041	623899	186	6	1.5	268.1
M74-19	292993	623693	192	12	1.5	266.3
B7078-1	292881	624578	0	0	1.5	262.5
B7078-2	292725	624702	307	127	1.5	266.1
B7078-3	292567	624825	303	123	1.5	268.6
B7078-4	292403	624938	288	108	1.5	271.1
B7078-5	292215	625004	270	90	1.5	272.9
B7078-6	292016	625008	255	75	1.5	269
B7078-7	291822	624960	259	79	1.5	258.5
B7078-8	291626	624928	267	87	1.5	247.9
B7078-9	291426	624924	274	94	1.5	249.5
B7078-10	291227	624944	280	100	1.5	255.7
B7078-11	291031	624982	285	105	1.5	262.4
B7078-12	290839	625037	289	109	1.5	267.3
B7078-13	290651	625106	291	111	1.5	271.8
B7078-14	290466	625181	295	115	1.5	279.6

Receptor	OS Coordinate (X)	OS Coordinate (Y)	View Direction A (°)	View Direction B (°)	Height above ground level (m)	Ground elevation (m)
B7078-15	290286	625268	299	119	1.5	281.8
A702-1	293302	623967	359	179	1.5	245.8
A702-2	293303	624167	351	171	1.5	243.5
A702-3	293278	624365	348	168	1.5	240.9
A702-4	293242	624562	330	150	1.5	237.4
A702-5	293149	624729	0	0	1.5	245.2
A702-6	293160	624918	11	191	1.5	240.5
A702-7	293204	625113	20	200	1.5	236.5
A702-8	293276	625299	20	200	1.5	233.1
A702-9	293350	625485	18	198	1.5	229.3
A702-10	293416	625673	9	189	1.5	231
A702-11	293451	625870	12	192	1.5	228.4
A702-12	293496	626064	31	211	1.5	227
A702-13	293604	626231	36	216	1.5	231.9
A702-14	293749	626347	43	223	1.5	228.2
A702-15	293888	626491	42	222	1.5	228.2
A702-16	294025	626637	49	229	1.5	228.2
A73-1	293714	626479	22	202	1.5	231.9
A73-2	293795	626662	22	202	1.5	236
A73-3	293876	626837	22	202	1.5	236
Local-1	290650	623069	100	280	1.5	270.2
Local-2	290846	623029	100	280	1.5	268.1
Local-3	291042	622990	48	228	1.5	273.2
Local-4	291189	623118	42	222	1.5	261
Local-5	291326	623264	37	217	1.5	253.5
Local-6	291449	623420	23	203	1.5	248.7
Local-7	291531	623601	16	196	1.5	250.8
Local-8	291591	623792	6	186	1.5	248.4
Local-9	291616	623988	0	180	1.5	247.9
Local-10	291623	624188	9	189	1.5	253.6
Local-11	291684	624376	345	165	1.5	260.6
Local-12	291636	624571	44	224	1.5	247.3
Local-13	293715	624298	352	172	1.5	241.8
Local-14	293692	624496	352	172	1.5	242.4

Receptor	OS Coordinate (X)	OS Coordinate (Y)	View Direction A (°)	View Direction B (°)	Height above ground level (m)	Ground elevation (m)
Local-15	293672	624695	358	178	1.5	240.1
Local-16	293883	626172	26	206	1.5	229.1
Local-17	293973	626346	26	206	1.5	226.7
Local-18	294068	626520	33	213	1.5	226.1
Local-19	294149	626637	30	210	1.5	224.9
Local-20	290412	625471	73	253	1.5	302.1
Local-21	290603	625523	68	248	1.5	304.4
Local-22	290790	625593	66	246	1.5	297.9
Local-23	290972	625666	71	251	1.5	289.4
Local-24	291162	625727	66	246	1.5	279.4
Local-25	291347	625804	75	255	1.5	269.7
Local-26	291539	625852	80	260	1.5	252.9
Local-27	291732	625879	65	245	1.5	240.4
Local-28	291907	625957	60	240	1.5	237.4
Local-29	292083	626050	45	225	1.5	243.4
Local-30	292227	626185	63	243	1.5	261
Local-31	292405	626270	77	257	1.5	272
Local-32	292601	626310	82	262	1.5	269.5
Local-33	292799	626332	95	275	1.5	263.3
Local-34	292996	626311	102	282	1.5	253.5
Local-35	293190	626263	97	277	1.5	248.5
Local-36	293388	626234	97	277	1.5	241.6
Local-37	291785	624716	24	204	1.5	255.7
Local-38	291872	624896	353	173	1.5	262.3

Rail Receptor Details

Receptor	OS Coordinate (X)	OS Coordinate (Y)	View Direction A (°)	View Direction B (°)	Height above ground level (m)	Total elevation (m)
1	293840	625971	200	20	2.7	232.6
2	293765	625786	195	15	2.7	234.9
3	293707	625595	190	10	2.7	235.7
4	293665	625399	185	5	2.7	234.7
5	293639	625201	180	360	2.7	237.5
6	293634	625001	175	355	2.7	236.3

Aviation Receptor Details

Receptor	OS Coordinate (X)	OS Coordinate (Y)	Height above ground level (m)	Total elevation (m)
Crawfordjohn Airfield A	283339	620699	250	517.1
Crawfordjohn Airfield B	283713	620897	250	516.4

Annex C – Assessment Results

Dwelling Results Summary

Receptor	Maximum Days/Year	Maximum Hours/Year	Maximum Mins/Day	Existing Screening?
Netherton	0	0	0	
Duneaton House	199	159.4	60	Partially screened (Array E fully screened by Craighead Hill, reducing days per year to 93)
Craighead	0	0	0	
Whitrae Wood 1	0	0	0	
Whitrae Wood 2	0	0	0	
Carlisle Road	0	0	0	
Nether Abington 1	0	0	0	
Nether Abington 2	0	0	0	
Cold Chapel	103	114.7	90	Screened by farm buildings
Dykefoot	163	113.3	55	Screened by trees
Littlegill Cottage	200	134.2	50	No screening
Littlegill	22	5.3	25	No screening
Bridegend Road	0	0	0	
Maidencots 1	0	0	0	
Maidencots 3	0	0	0	
Whitrae Wood 1	0	0	0	

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
M74-1	N	125	N				305	N				No Impact		Glint and glare is not geometrically possible at these receptors. No impact is predicted.
M74-2	N	127	N				307	N				No Impact		
M74-3	N	127	N				307	N				No Impact		
M74-4	N	127	N				307	N				No Impact		
M74-5	N	127	N				307	N				No Impact		
M74-6	Y	127	Y	No	400	AM, East	307	N				High Impact	Required	Glint and glare is geometrically possible, and effects are within the FOV of southbound traffic. Visibility exists towards the panels (no existing screening is present), therefore a high impact is predicted and mitigation is required to reduce impact.
M74-7	Y	127	Y	Partial	100	AM, East	307	Y	Yes			Moderate Impact	Recommended	Glint and glare is geometrically possible, and effects are within the FOV of road users in both northbound and southbound carriageways. However, visibility is partially screened by existing landscaping, and further mitigation is required to reduce impact.
M74-8	Y	127	Y	Partial	100	AM, East	307	Y	Yes			Moderate Impact	Recommended	
M74-9	Y	127	Y	No	180	AM, East	307	Y	No	80	PM, West	High Impact	Required	Glint and glare Predicted, no mitigation (screening) exists, mitigation is required to reduce impact.
M74-10	Y	130	Y	Yes			310	Y	No	80	PM, West	High Impact	Required	
M74-11	Y	140	Y	No	50	AM, East	320	Y	No	30	PM, West	High Impact	Required	
M74-12	Y	150	N				330	Y	No	30	PM, West	High Impact	Required	

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
M74-13	Y	160	N				340	Y	Partial	50	PM, West	Moderate Impact	Recommended	Glint and glare Predicted, partial mitigation (screening) exists, additional mitigation is recommended to reduce impact.
M74-14	Y	164	N				344	Y	Yes			Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north. Existing mitigation is in place, in the form of earthworks which form the motorway junction, which fully screen the PV Arrays.
M74-15	Y	164	N				344	Y	Yes			Low Impact		
M74-16	Y	166	N				346	Y	Yes			Low Impact		
M74-17	Y	177	N				357	N				Low Impact		Glint and glare geometrically possible, however not within the FOV of road users.
M74-18	Y	186	N				6	N				Low Impact		
M74-19	Y	192	N				12	N				Low Impact		
B7078-1	Y	N/A	N/A	No	400	PM, West	N/A	N/A	No	400	PM, West	High Impact	Required	GG Predicted, no mitigation (screening) exists, mitigation is required to reduce impact.
B7078-2	Y	307	Y	Partial	220	PM, West	127	N				Moderate Impact	Recommended	Glint and glare Predicted, partial mitigation (screening) exists, additional mitigation is recommended to reduce impact.
B7078-3	Y	303	Y	No	150	PM, West	123	Y	No	70	AM, East	High Impact	Required	Glint and glare Predicted, no mitigation (screening) exists, mitigation is required to reduce impact.
B7078-4	Y	288	Y	No	40	PM, North	108	Y	No	30	AM, East	High Impact	Required	

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
B7078-5	Y	270	N				90	Y	Yes			Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling east. However, existing screening is in place in the form of terrain.
B7078-6	Y	255	N				75	Y	Yes			Low Impact		
B7078-7	Y	259	N				79	Y	Yes			Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling east. However, existing screening is in place in the form of terrain and trees.
B7078-8	Y	267	N				87	Y	Yes			Low Impact		
B7078-9	Y	274	N				94	Y	Yes			Low Impact		
B7078-10	Y	280	N				100	Y	Partial	920	AM, East	Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling east. However, existing mitigation is in place in the form of terrain landform which screen the majority of PV panels, and other mitigating factors including the distance to the panels (920m) and the sun being incident to the direction of glare, mean that the impact is anticipated to be low.
B7078-11	Y	285	N				105	N				No Impact		Glint and glare is not geometrically possible at these receptors. No impact is predicted.
B7078-12	Y	289	N				109	N				No Impact		
B7078-13	Y	291	N				111	N				No Impact		
B7078-14	Y	295	N				115	N				No Impact		
B7078-15	Y	299	N				119	N				No Impact		
A702-1	Y	359	N				179	N				No Impact		

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
A702-2	Y	351	N				171	N				No Impact		
A702-3	Y	348	N				168	N				No Impact		
A702-4	Y	330	Y	Yes			150	N				Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north. Existing mitigation is in place, in the form of terrain and trees.
A702-5	Y	N/A	N/A	Yes			N/A	N/A	Yes			Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north and south. Existing mitigation is in place, in the form of terrain and trees.
A702-6	Y	11	N				191	N				Low Impact		Glint and glare geometrically possible, however not within the FOV of road users.
A702-7	Y	20	N				200	N				Low Impact		
A702-8	Y	20	N				200	N				Low Impact		
A702-9	Y	18	N				198	N				Low Impact		
A702-10	Y	9	N				189	N				Low Impact		
A702-11	Y	12	N				192	N				Low Impact		
A702-12	N	31	N				211	N				No Impact		Glint and glare is not geometrically possible at these receptors. No impact is predicted.
A702-13	N	36	N				216	N				No Impact		
A702-14	N	43	N				223	N				No Impact		
A702-15	N	42	N				222	N				No Impact		
A702-16	N	49	N				229	N				No Impact		

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
A73-1	N	22	N				202	N				No Impact		
A73-2	N	22	N				202	N				No Impact		
A73-3	N	22	N				202	N				No Impact		
Minor-1	N	100	N				280	N				No Impact		
Minor-2	N	100	N				280	N				No Impact		
Minor-3	N	48	N				228	N				No Impact		
Minor-4	N	42	N				222	N				No Impact		
Minor-5	N	37	N				217	N				No Impact		
Minor-6	N	23	N				203	N				No Impact		
Minor-7	N	16	N				196	N				No Impact		
Minor-8	Y	6	N				186	N				Low Impact		Glint and glare geometrically possible, however not within the FOV of road users.
Minor-9	Y	0	N				180	N				Low Impact		
Minor-10	Y	9	Y	Yes			189	N				Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north. Existing mitigation is in place, in the form of terrain.
Minor-11	Y	345	Y	No	240	PM, West	165	N				Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north. However, due to the status of the road (local road, primarily for access to properties), no mitigation is proposed.

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
Minor-12	Y	44	Y	Yes			224	Y	No	190	PM, West	Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north and south. However, due to the status of the road (local road, primarily for access to properties), no mitigation is proposed.
Minor-13	Y	352	N				172	N				Low Impact		Glint and glare geometrically possible, however not within the FOV of road users.
Minor-14	Y	352	N				172	N				Low Impact		
Minor-15	Y	358	N				178	N				Low Impact		
Minor-16	N	26	N				206	N				No Impact		Glint and glare is not geometrically possible at these receptors. No impact is predicted.
Minor-17	N	26	N				206	N				No Impact		
Minor-18	N	33	N				213	N				No Impact		
Minor-19	N	30	N				210	N				No Impact		
Minor-20	Y	73	N				253	N				Low Impact		Glint and glare geometrically possible, however not within the FOV of road users.
Minor-21	Y	68	N				248	N				Low Impact		
Minor-22	Y	66	N				246	N				Low Impact		
Minor-23	Y	71	N				251	N				Low Impact		
Minor-24	Y	66	Y	No			246	N				Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling east. However, due to the status of the road (local road, single-track primarily for access to properties), no mitigation is proposed.
Minor-25	Y	75	Y	No			255	N				Low Impact		

Receptor	G&G Geometrically Possible (360° FOV)	100° FOV A (50° either side of view direction A)					100° FOV B (50° either side of view direction B)					Impact	Mitigation	Conclusion
		View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position	View Direction (°)	Geometrically Possible	Visibility (Screening)	Separation Distance (m)	Occurrence Time, Sun Position			
Minor-26	Y	80	Y	No			260	N				Low Impact		
Minor-27	Y	65	Y	No			245	N				Low Impact		
Minor-28	Y	60	Y	Yes			240	N				Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north. Existing mitigation is in place, in the form of terrain (the road at this section goes through and underpass below the M74).
Minor-29	N	45	N				225	N				No Impact		Glint and glare is not geometrically possible at these receptors. No impact is predicted.
Minor-30	N	63	N				243	N				No Impact		
Minor-31	N	77	N				257	N				No Impact		
Minor-32	N	82	N				262	N				No Impact		
Minor-33	N	95	N				275	N				No Impact		
Minor-34	N	102	N				282	N				No Impact		
Minor-35	N	97	N				277	N				No Impact		
Minor-36	N	97	N				277	N				No Impact		
Minor-37	Y	24	Y	Yes			204	N				Low Impact		Glint and glare geometrically possible, and is within FOV for road users travelling north. Existing mitigation is in place, in the form of terrain.
Minor-38	Y	353	N				173	N				Low Impact		Glint and glare geometrically possible, however not within the FOV of road users.

Rail Receptor Details

Receptor	View Direction A (°)	View Direction B (°)	360° FOV		60° FOV Northbound		60° FOV Southbound	
			Hrs/Yr	Mins/Day	Hrs/Yr	Mins/Day	Hrs/Yr	Mins/Day
1	200	20	0	0	0	0	0	0
2	195	15	108.2	60	0	0	0	0
3	190	10	130.2	50	0	0	0	0
4	185	5	121.9	45	0	0	0	0
5	180	360	108.5	50	0	0	0	0
6	175	355	46.2	35	0	0	0	0